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09/759,054	01/10/2001	Gabor Kalman	050-99-050	1934

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Honeywell International, Inc.
Patent Service AB-2B
101 Columbia Road
P.O. Box 2245
Morristown, NJ 07962-2245

EXAMINER	
LAXTON, GARY L	

ART UNIT	PAPER NUMBER
2838	

DATE MAILED: 11/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/759,054	Applicant(s) KALMAN ET AL.	
	Examiner Gary L. Laxton	Art Unit 2838	MW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,9,10,12-16,18,19 and 21* is/are rejected.

7)☒ Claim(s) *8,11,17 and 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *9* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. The indicated allowability of claims 1-21 is withdrawn in view of the newly discovered reference(s) to US 5,949,664 Bernet et al. Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

3. Claims 1, 2, 5, 10, 13, 15, 19 and 21 are rejected under 35 U.S.C. 102(a) as being anticipated by Bernet et al.

Claim 1, Bernet et al disclose a power conversion apparatus (figures 1A, 1B) comprising; a source side inverter (Fig 1A) including on/off switches (S1-S6); a drive side inverter (Fig 1B) including on/off switches (S'1- S'6); a dc current link (Fig 1A, 16, 44) coupled between an output of the source side inverter and an input of the drive side inverter; and a controller (22) for operating the source side inverter in current mode and the drive side inverter in a commutation mode to achieve sinusoidal input currents at an input of the source side inverter and sinusoidal output currents at an output of the driver side inverter (Col. 5 lines 40-43; col. 6 lines 10-43 esp. lines 35-40).

Claim 2, Bernet et al discloses a power conversion apparatus (figure 1A, 1B) comprising; a source side inverter (Fig 1A); a drive side inverter (Fig 1B); a dc current link (Fig 1A, 16, 44) coupled between an output of the source side inverter and an input of the drive side inverter; and a controller (22) for operating the source side inverter in current mode and the drive side inverter in a commutation mode (Col. 5 lines 40-43; col. 6 lines 10-43 esp. lines 35-40), the controller commanding the source side inverter to perform current regulation on the dc current link during a first portion of each modulating cycle and current mode space vector modulation during a second portion of each modulating cycle (space vector modulation is a current regulation scheme; see also modulation cycle: col. 13 lines 35-67; col. 14 lines 1-16; col. 14 lines 43-47).

Claim 5, during each second portion the controller modulates switches of the source side inverter to extract fundamental frequency sinusoidal currents from an ac power source (this is inherent, see also col. 2 lines 10-17).

Claim 10, the controller commands the drive side inverter to generate active vectors only; and wherein null vectors are imposed by the source side inverter (col. 5 lines 35-40; col. 13 line 63; col. 14 lines 43-46, line 56).

Claim 13, a controller (22) for a first inverter (Fig 1A) coupled between a power source and a dc current link (Fig 1A, 16, 44) and a second inverter (Fig 1B) coupled between an ac drive and the dc link, the controller (22) comprising; a circuit (figures 10 and 11) for commanding the first inverter to perform a current regulation on the dc current link during a first portion of each modulating cycle and current mode space vector modulation during a second portion of each modulating cycle (space vector modulation is a current regulation scheme; see also modulation cycle: col. 13 lines 35-67; col. 14 lines 1-16; col. 14 lines 43-47); the circuit commanding the

second inverter to operate in commutation mode (Col. 5 lines 40-43; col. 6 lines 10-43 esp. lines 35-40).

Claim 15, the first inverter is terminated in a capacitor bank; wherein the space vector modulation produces a current vector; and wherein the circuit uses phase angle of the current vector to command switches of the first inverter to connect selected phases of the capacitor bank of the dc current link (this is normal space vector modulation and inherent).

Claim 19, the circuit commands the second inverter to generate active vectors only; and wherein null vectors are imposed by the first inverter (col. 5 lines 35-40; col. 13 line 63; col. 14 lines 43-46, line 56).

Claim 21, an apparatus comprising; an ac motor (col. 2 line 51); a first switch based inverter (Fig 1A) having an input adapted to receive ac power (Vas, Vbs, Vcs); a second switch based inverter (Fig 1B) coupled to the ac motor (load: V'as, V'bs, V'cs) and means (22) for operating the first inverter in current mode and the second inverter in commutation mode to achieve sinusoidal input currents at an input of the first inverter and sinusoidal output current at an output of the second inverter(Col. 5 lines 40-43; col. 6 lines 10-43 esp. lines 35-40).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 3 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernet et al.

Bernet et al disclose the claimed subject matter in regards to claims 2 and 13, supra, except for the controller varies the duty cycle of each first portion to control average current in the dc link. Bernet et al teach a Pulse Width Modulated system in which the duty cycle is varies in order to modulate the pulse width to provide the desired on time and off time for the switch to control the current.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize a controller that varies the duty cycle of each first portion to control average current in the dc link in order to modulate the pulse width to provide the desired on time and off time for the switch to control the current.

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bernet et al in view of Ma et al (US 6,366,483).

Bernet et al disclose the claimed subject matter in regards to claim 2, supra, except for the controller operates the source side inverter as a buck chopper during each first portion to perform the current regulation.

Ma et al (483') teaches of a PWM Rectifier with power factor correction and current control and further specifically teaches the illustrated rectifier (24) can be implemented using other types of rectifiers such as a dc chopper (col. 8 line 63); therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the rectifier of

Bernet et al to include a dc chopper with the suggestion of Ma et al (483') of using a dc chopper rectifier as an alternative rectifier implementation (col. 8 line 63).

7. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bernet et al in view of Rozman.

Bernet et al disclose the claimed subject matter in regards to claim 5, supra, and the source side inverter is terminated in a capacitor bank (Fig 1A); and the space vector modulation produces a current vector; and wherein the controller uses phase angle of the current vector to command the source side inverter switches to connect selected phases of the capacitor bank capacitors to the dc current link, supra claim 2.

However, Bernet et al do not teach maintaining a relatively ripple free current on the dc link.

Rozman teaches a AC/DC converter system with a capacitor bank and current regulator in figure 1 and specifically teaches controlling the rectifier converter so as to reduce ripple on the DC link (col. 4 lines 36-46 and col. 8 lines 54-57).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to maintain a relatively ripple free current on the dc link as specifically suggested and taught by Rozman (col. 4 lines 36-46 and col. 8 lines 54-57) in order to provide a smooth and ripple output to by used by a load.

8. Claims 7 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernet et al in view of Rozman as applied to claim 6 above, and further in view of Ma et al (US 6,366,483).

Bernet et al disclose the claimed subject matter in regards to claims 6 and 15 supra, except for the controller also performs damping during each second portion of the modulating cycle by modifying the phase angle.

Ma et al (483') teaches of a PWM Rectifier with power factor correction and current control and further specifically teaches active damping by modifying the phase angle (col. 8 lines 35-41, inter alia) in order to prevent the rectifier from resonant oscillation and to suppress resonance modes (col. 4 lines 38-40).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to perform damping during each second portion of the modulating cycle by modifying the phase angle in order to prevent the rectifier from resonant oscillation and to suppress resonance modes (col. 4 lines 38-40) as taught by Ma et al (483').

9. Claims 9 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernet et al in view of Kalman et al (US 5,428,283).

Bernet et al disclose the claimed subject matter in regards to claims 1 and 13, supra, except for the controller performs power factor control of the drive side inverter such that motor current is in phase with motor back emf.

Kalman et al teaches power factor control of a pulse width modulated inverter supplied permanent magnet motor for power factor changes in accordance with changes in emf and motor resistance (abstract).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the controller of Bernet et al to perform power factor control of

the drive side inverter such that motor current is in phase with motor back emf as taught by Kalman et al in order to maintain approximately unity power factor over a wide range of EMF (i.e. magnet strength) and/or temperature (i.e. ohmic resistance) changes (col. 3 lines 5-11).

10. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bernet et al in view of Jiang.

Bernet et al disclose the claimed subject matter in regards to claims 1 and 13, supra, except for the dc current link include a diode bridge for bi-directional flow.

Jiang figure 8 teaches using a diode bridge connected between an inverter and converter for bi-directional power flow therebetween.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the circuit of Bernet et al to include a diode bridge in the dc link in order to provide for bi-directional power flow from the inverter to the converter and vice versa as suggested by Jiang.

Allowable Subject Matter

11. Claims 8, 11, 17 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. The following is a statement of reasons for the indication of allowable subject matter:

Concerning claim 8, prior art fails to disclose or suggest, inter alia, an apparatus for power conversion having a controller that modifies a phase angle used for damping by computing a Park vector of a capacitor bank voltage, computing a second vector representing resonant frequencies of the voltage Park vector, regulating the second vector, and using the regulated vector to correct the phase angle.

Concerning claim 11, prior art fails to disclose or suggest, inter alia, an apparatus for power conversion having a controller to generate a rotor position vector, compute a motor current Park vector that is synchronous with an emf vector, PI regulates an imaginary portion of the synchronous motor current Park vector, then uses the regulated imaginary portion to shift the position signal and then uses the shifted signal to drive the switches.

Concerning claim 17, prior art fails to disclose or suggest, inter alia, a controller having a circuit that modifies the phase angle by computing a Park vector of capacitor bank voltage, computing a second vector representing resonant frequencies of the voltage Park vector, regulating the second vector, and using the regulated vector to correct the phase angle.

Concerning claim 20, prior art fails to disclose or suggest, inter alia, a controller generates a vector indicating back emf, computes a current Park vector that is synchronous with respect to the back emf vector, PI-regulates an imaginary portion of the synchronous current Park vector, and uses the regulated imaginary portion to select switches of the second inverter.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gary L. Laxton whose telephone number is (703) 305-7039. The examiner can normally be reached on Monday thru Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Sherry can be reached on (703)308-1680. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

10/17/03

MICHAEL SHERRY
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

Gary L. Laxton
Patent Examiner
Art Unit 2838

GLL